Robust FARADAYIC CNT Based Coating for Scattered Light Suppression, Phase I

Completed Technology Project (2018 - 2019)

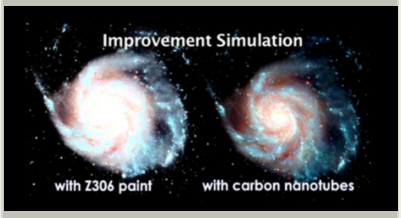
Project Introduction

Space-borne instruments, such as telescope housings and baffles where stray light reduction is vital requires the reduction of the stray light from optical payloads. Low reflective coatings (with reflectivity of ~0.1% or less) in the broad spectral range (visible- near infrared) have to be developed. These black coatings should also withstand aggressive space environments and launch conditions with marginal impact on their adhesion and optical performance. A promising candidate with an outstanding diffuse absorptance is chemically vapor deposited layers of carbon nanotubes. However, these coatings are typically grown by expensive and thermally based techniques and can be difficult to apply to 3D structures. Phase I will demonstrate the feasibility of a low-cost, efficient and scalable manufacturing process for the deposition of durable, low reflectivity CNT black coatings based on the use of pulse and pulse reverse electrophoretic deposition. This technology will enable the conformal deposition of CNT black coatings on complex shapes and sharp edges on commonly used spacecraft materials such as aluminum and titanium substrates. In Phase I, Faraday will develop an electrophoretic bath formulation and manipulate the pulsed electric field parameters to deposit dense, vertically aligned multi-walled carbon nanotubes onto test substrates, and characterize the deposited coatings to show the potential of achieving the desired reflectivity of 0.1% or less, monitor the thickness uniformity and morphology and demonstrate the potential for durability in severe launch conditions. Finally, a preliminary techno-economic will be completed to show the potential to reduce the cost of existing processes while maintaining required optical properties. Phase II would optimize the deposition parameters, elucidate their effect on scattered light suppression and thermal-structural performance, process alpha-scale components, and, to the extent possible, perform a system-level validation.

Anticipated Benefits

The key first customer for the proposed technology is NASA and their prime contractors for space missions. The applications include optical components where broadband absorption of electromagnetic radiation is critical, including for detectors and high-sensitivity optical systems. Solar coronagraphs and space-borne instruments, for example telescope housings and baffles, require stray light reduction.

In addition to the NASA's space missions, availability of black optical coating technology might open up new markets such as military applications including missile seeker, surveillance, night vision cameras, thermal imaging and shielded windows. We also envision this technology application in other areas including: electronics and telecommunications, semiconductors, solar panels, automobile industry or any other technology that suffers from scattered light reflection.



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Small Business Innovation Research/Small Business Tech Transfer

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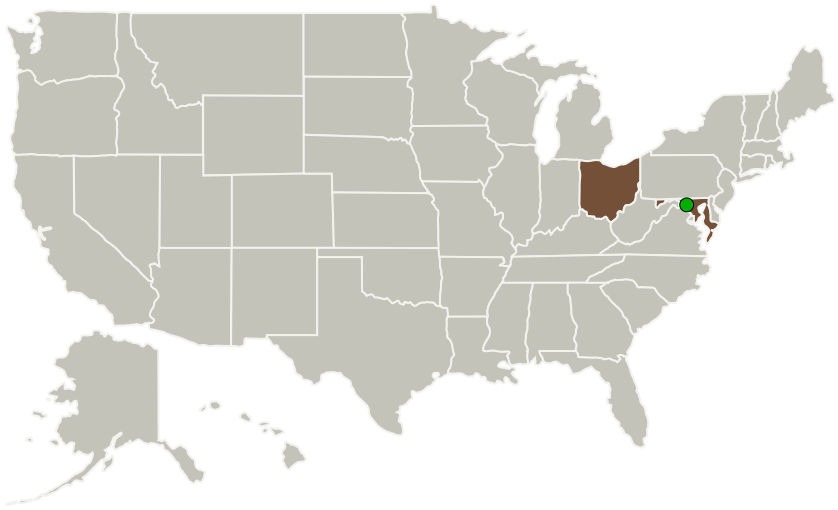
Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
Faraday Technology, Inc	Lead Organization	Industry	Clayton, Ohio
Goddard Space Flight Center(GSFC)	Supporting Organization	NASA Center	Greenbelt, Maryland

Primary U.S. Work Locations	
Maryland	Ohio

Project Transitions

July 2018: Project Start

February 2019: Closed out

Closeout Documentation:

- Final Summary Chart*(https://techport.nasa.gov/file/141271)*

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Faraday Technology, Inc

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

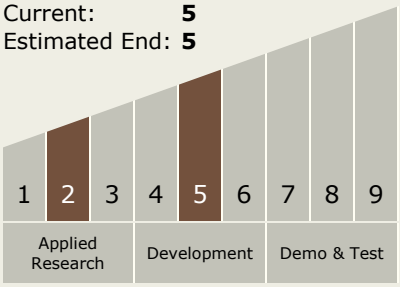
Carlos Torrez

Principal Investigator:

Dan Wang

Technology Maturity (TRL)

Start: **2**
Current: **5**
Estimated End: **5**



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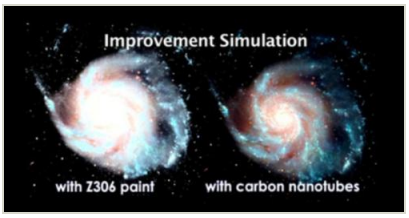
Images



Briefing Chart Image
Robust FARADAYIC CNT Based Coating for Scattered Light Suppression, Phase I
(https://techport.nasa.gov/image/131447)

Final Summary Chart Image
Robust FARADAYIC CNT Based Coating for Scattered Light Suppression, Phase I
(https://techport.nasa.gov/image/131174)

Technology Areas

Primary:

- TX08 Sensors and Instruments
  - TX08.1 Remote Sensing Instruments/Sensors
    - TX08.1.3 Optical Components

Target Destinations

The Sun, Outside the Solar System